The degree of financial integration in the European Community

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J.J.G. Lemmen and S.C.W. Eijffinger

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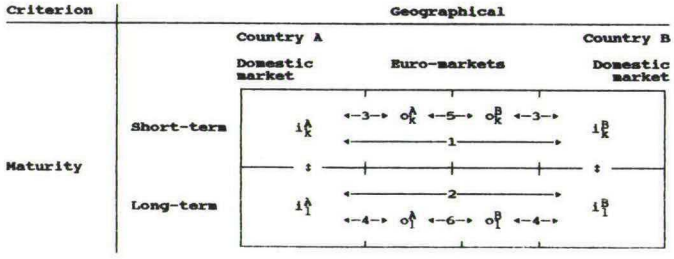
1 INTRODUCTION

The aim of this paper is to measure the degree of financial integration in the European Community (EC) and how this is changing over time. Figure 1 shows a schematic overview of the financial relationships which exist between financial markets in the EC. A geographical criterion and a maturity criterion are used to structure these financial relationships. The geographical criterion splits financial markets into domestic financial markets, euro-markets and foreign financial markets. The maturity criterion splits financial assets into assets with a short-term and a long-term maturity. Short-term debt instruments are traded in the money market and normally have a maturity of less than one year. Long-term debt instruments and equity instruments are traded in the capital market and normally have a maturity of more than one year (Mishkin 1989, p. 47). Financial assets are denominated in currency A or B. We assume that countries A and B are EC member states. Of course the scheme could equally well represent financial relationships in the world.

Figure 1: Financial markets and financial relationships in the EC



with:

i_k^A = short-term interest rate domestic money market country A
i_k^B = short-term interest rate domestic money market country B
i_l^A = long-term interest rate domestic capital market country A
i_l^B = long-term interest rate domestic capital market country B
o_k^A = 'off shore' interest rate euro-currency market, financial assets denominated in currency A
o_k^B = 'off shore' interest rate euro-currency market, financial assets denominated in currency B
o_l^A = 'off shore' interest rate euro-capital market, financial assets denominated in currency A
o_l^B = 'off shore' interest rate euro-capital market, financial assets denominated in currency B

We identify financial integration in the EC with the cross-country integration of money and capital markets of EC member states.[1]

[1] According to the Cecchini Report (1988), financial integration also covers the right of establishment and the provision of financial services, including banking, insurance and securities markets.

Only the integration between the domestic financial markets of countries A and B constitutes financial integration in the EC (' ◂–1–▸' and ' ◂–2–▸'). The integration between financial markets within country A or B (' ↕') and the integration between domestic financial markets and euro-markets (' ◂–3–▸' and ' ◂–4–▸') does not fit into our concept of financial integration in the EC. The integration between the euro-markets in question also does not fit into our concept of financial integration in the EC because transactions do not cross national borders (' ◂–5–▸' and ' ◂–6–▸'). The notion of financial integration is closely related to the notion of capital mobility. In section 2 particular attention is given to four different definitions of perfect capital mobility.

2 FOUR DIFFERENT DEFINITIONS OF PERFECT CAPITAL MOBILITY

Frankel (1989) sets out an ascending order of four different definitions of perfect capital mobility according to their cumulative assumptions. These four different definitions of perfect capital mobility correspond to four different criteria which are summarized in table 1.

Table 1: Four different definitions of perfect capital mobility, their corresponding criteria and their cumulative assumptions

I Covered nominal interest parity

Assumption:
1: $i_t - i_t^* - fd_t = 0$ or $D_t + B_t = 0$

Covered nominal interest parity plus zero currency risk premium ($fd_t - \Delta s_t^e$) leads to

II Ex ante uncovered nominal interest parity

$i_t - i_t^* - \Delta s_t^e = 0$

Assumptions:
1: $(i_t - i_t^* - fd_t) = 0$ or $D_t + B_t = 0$
2: $(fd_t - \Delta s_t^e) = 0$ or $C_t = 0$

Ex ante uncovered nominal interest parity plus zero expected real exchange rate change (Δs_{rt}^e) leads to

III Ex ante real interest parity

$E(r_t - r_t^*) - \Delta s_{rt}^e = 0$

Assumptions:
1: $(i_t - i_t^* - fd_t) = 0$ or $D_t + B_t = 0$
2: $(fd_t - \Delta s_t^e) = 0$ or $C_t = 0$
3: $\Delta s_{rt}^e = \Delta s_t^e - E(p_t - p_t^*) = 0$

Ex ante real interest parity plus zero correlation between all other factors that determine investment (μ_i) and the expected real foreign interest rate $E(r_t^*)$ with the gross national savings rate $(S_t/Y_t)_i$ leads to

IV The Feldstein-Horioka condition: no correlation between the gross national savings rate $(S_t/Y_t)_i$ and the gross domestic investment rate $(I_t/Y_t)_i$

$(I_t/Y_t)_i = \alpha + \beta\,(S_t/Y_t)_i + \epsilon_i$

Assumptions:
1: $(i_t - i_t^* - fd_t) = 0$
2: $(fd_t - \Delta s_t^e) = 0$
3: $\Delta s_{rt}^e = \Delta s_t^e - E(p_t - p_t^*) = 0$
4: $Cov(\mu_i, S_t/Y_t) = 0$
5: $Cov(E(r_t^*), S_t/Y_t) = 0$

} $Cov(E(r_t - r_t^*), S_t/Y_t) = 0$

The first criterion - the covered nominal interest parity (CIP) - examines perfect capital mobility of type I. IF CIP holds the forward

premium or discount (fd_t) equals the interest differential at the appropriate maturity ($i_t-i_t^*$). Perfect capital mobility of type I means that the covered nominal interest differential ($i_t-i_t^*-fd_t$) is zero. For comparable assets issued in different countries and denominated in different currencies ($D_t=0$) the covered nominal interest differential reflects barriers to cross border capital flows (B_t) or in other words a country premium. The second criterion -ex ante uncovered nominal interest parity (UIP) - examines whether there is perfect capital mobility of type II or as it is sometimes called perfect capital substitutability. If UIP holds the expected nominal exchange rate change (Δs_t^e) equals the interest differential at the appropriate maturity ($i_t-i_t^*$). Perfect capital mobility of type II means that the ex ante uncovered nominal interest differential ($i_t-i_t^*-\Delta s_t^e$) is zero. As can be seen in table 1, the UIP condition needs an additional assumption to the CIP condition i.e. zero currency risk premium. The third criterion - ex ante real interest parity (RIP) - examines whether there is perfect capital mobility of type III or in other words perfect financial and non-financial capital mobility. Non-financial capital mobility refers to the mobility of goods and services and the mobility of the production factors labour and physical capital. If RIP holds the expected real exchange rate change (Δs_{rt}^e) equals the ex ante real interest differential at the appropriate maturity $E(r_t-r_t^*)$. RIP requires not only UIP but also a zero expected real exchange rate change (ex ante relative purchasing power parity). The fourth criterion - the Feldstein-Horioka (F-H) condition - examines whether there is perfect capital mobility of type IV. The F-H condition infers from the correlation between the savings and investment rates the degree of capital mobility of type IV. The F-H condition needs two additional assumptions to the RIP condition and is therefore the strongest criterion for financial integration.

In our research all four criteria are used to assess the degree of financial integration. However, the criteria measure different types of *perfect* capital mobility.[2] As will become clear, we slightly prefer the CIP and the UIP condition to asses the degree of financial integration because the CIP and the UIP condition assess two important theoretical aspects of financial integration i.e. the *ability* and the *willingness* to move financial assets across national borders

[2] In real world, of course, the degree of capital mobility lies somewhere between perfect and zero capital mobility of a particular type.

in response to expected differences in exchange-adjusted returns (see for example Boothe et al. 1985, Caramazza et al. 1986, Akhtar and Weiller 1987, Reinhart and Weiller 1987a). Capital substitutability refers to the willingness of investors to change relative shares of their portfolio in response to a change in expected relative returns. Whether asset stocks actually change depends on the ability of investors to adjust their portfolios.[3] The CIP condition examines the ability of capital movements while the UIP condition examines the willingness of capital movements. The RIP and F-H condition, however, not only measures the degree of financial integration but also the degree of real integration and therefore have less explanatory power with respect to the degree of financial integration.

Capital mobility can be framed in terms of prices and in terms of quantities. The first three criteria in table 1 rely on the co-movement of domestic and foreign *prices* (i.e. interest rates) and fit into the price approach. Criterion IV, however, relies on the co-movement of domestic *quantities* and fits into the quantity approach. The remainder of this paper is organized as follows. The quantity approach is examined in section 3 and the price approach is examined in section 4. Section 5 concludes the paper.

3 THE QUANTITY APPROACH

3.1 The Feldstein-Horioka condition and cross-section analysis

An influential criterion for measuring the degree of financial integration originated in 1980 when F-H asserted that one could deduce from the national accounting framework the degree of financial integration. F-H asserted that changes in ex post gross national savings (S_t) and/or ex post gross domestic investment (I_t) resulted in changes in the current account balance (CA_t).[4] Assuming that the capital account balance is the opposite of the current account balance they concluded that the degree of financial integration had changed. The F-H condition for testing the degree of financial integration with cross-section data can be specified as follows:

[3] Akhtar and Weiller (1987, p. 19) argue: 'In practice, componants of rates of return, e.g. exchange rates, may adjust quickly without actual movements of capital, that is capital mobility (of type I) may be just incipient.'

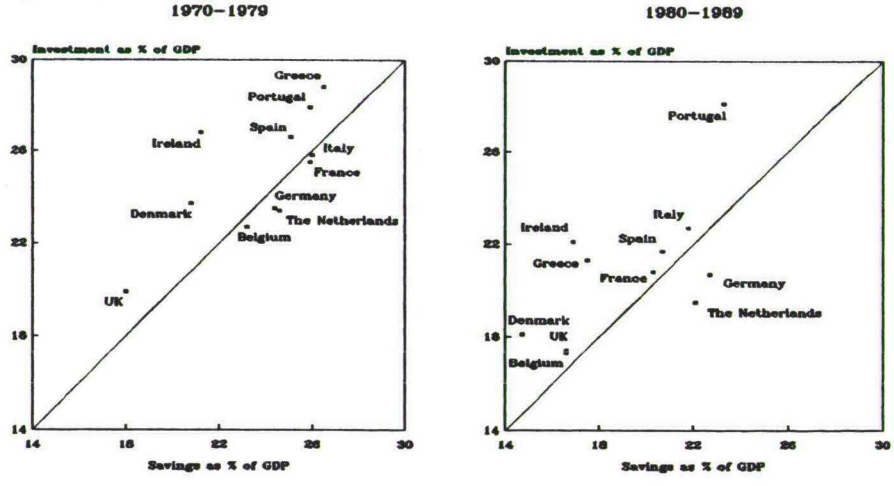
[4] Feldstein and Horioka use the word gross domestic savings. The appropiate variable is gross national savings (Tesar 1991, p. 56).

$$(I_t/Y_t)_i = \alpha + \beta\ (S_t/Y_t)_i + \epsilon_i \qquad (1)$$

where ϵ stands for the error term, t stands for the sample period and i stands for different countries. F-H divide gross domestic investment (I_t) and gross national savings by the gross domestic product (Y_t) to correct for the size differences between EC countries.

Feldstein and Bacchetta (1989) first estimated this standard cross-section specification in level form of the F-H condition for a sample of nine EC countries with ordinary least squares (OLS). For the F-H condition to be a valid criterion for the degree of financial integration in the EC, differences between EC member states with respect to the degree of financial integration should not be too big. This is why Feldstein and Bacchetta probably exclude the last EC entrants Spain and Portugal (assuming low financial integration) and Luxemburg (assuming high financial integration). Figure 2, however, shows that Portugal and Spain are less extreme outliers than Greece and Ireland. Feldstein and Bacchetta would have done better to also exclude Greece and Ireland in their sample.[5]

Figure 2: S_t/Y_t versus I_t/Y_t for EC member states (excluding Luxemburg), Averages during the period 1970-1979 and the period 1980-1989[6]



Source: OECD (1991), National Accounts of OECD Countries, Main Aggregates 1960-1989, Volume I.

We graph the share of gross domestic investment in GDP against the share of gross national savings in GDP for all EC countries

[5] Another reason for also excluding Greece is that Greece is the only EC member state which national accounting definitions of savings and investment are based on the earlier S.N.A.-definitions (see data appendix).

[6] Luxemburg lies out of the range of the graph.

except Luxemburg (see also Tesar 1991, p. 61). Figure 2 is a first illustration of the relationships subsequently found by OLS-estimation of the F-H condition. An observation on the 45°-line indicates that the country's current account is balanced. An observation above the 45°-line reflects a current account deficit i.e. the country's domestic investment exceeds its supply of national savings and the country is a net borrower in the international capital market.

In our study we extend the sample period of the Feldstein and Bacchetta study which ends in 1986 to 1989. The sample period 1970-1989 is divided into two equal sub-periods: 1970-1979 and 1980-1989. The ratios of savings and investment to GDP are averaged over the period 1970-1980 and the sub-periods 1970-1979 and 1980-1989 in order to avoid bias caused by the correlation of savings and investment over the business cycle. The data used are taken from the National Accounts of OECD countries (see data appendix).

Following Feldstein and Horioka (1980) and Feldstein (1983) we simultaneously test the null hypothesis H_0: $\beta = 0$ against the alternative hypothesis H_1: $\beta \neq 0$ and the null hypothesis H_0: $\beta = 1$ against the alternative hypothesis H_1: $\beta \neq 1$.[7]. When the coefficient β is insignificantly different from zero and significantly different from one we can statistically speak of perfect capital mobility of type IV.[8] Three assumptions must hold before no correlation between $(S_t/Y_t)_i$ and $(I_t/Y_t)_i$ exists or in other words perfect capital mobility of type IV is to be expected. First, ex ante RIP must hold [$Cov(E(r_t - r_t^*), S_t/Y_t)$], second, the foreign expected real interest rate must be determined exogenously to the country in question [$Cov(E(r_t^*), S_t/Y_t)$] and third, zero correlation between all other variables that affect the gross domestic investment rate, other than the ex ante real interest rate, and the gross national savings rate [$Cov(\mu, S_t/Y_t)$]. Dooley et al. (1987) summarize these three assumptions in the following equation:

$$Cov(I_t/Y_t, S_t/Y_t) = Cov(\mu, S_t/Y_t) - \Phi Cov(E(r_t^*), S_t/Y_t) - \Phi Cov(E(r_t - r_t^*), S_t/Y_t) = 0 \quad (2)^9$$

[7] Obstfeld (1986, p. 66) argues: 'Since the least-square estimate of β is not, strictly speaking, a correlation coefficient, there is no reason for it to be less than 1.'

[8] In an economic sense; when β is exactly 0, capital of type IV is said to be perfectly mobile, when $\beta < 0$, $0 < \beta < 1$ and $\beta > 1$ capital of type IV is said to be imperfectly mobile and when β is exactly 1 capital of type IV is said to be perfectly immobile.

Perfect capital mobility	Imperfect capital mobility		Perfect capital immobility
$\beta < 0$	$\beta = 0$	$0 < \beta < 1$	$\beta = 1$ $\beta > 1$

[9] The equation is based on the specification of the F-H condition used with cross-section analysis: $(I_t/Y_t)_i = \alpha + \beta(S_t/Y_t)_i + \varepsilon_i$. For convenience, we omitted the subscripts i.

In table 2 the results of testing the degree of financial integration in the EC with cross-section data are summarized.

Table 2: The F-H condition and cross-section analysis of nine EC member states (excluding Spain, Portugal and Luxemburg): $(I_t/Y_t)_i=\alpha+\beta(S_t/Y_t)_i+\epsilon_i$

Period (t)	α	β	R^2	$Cor[(S_t\backslash Y_t)_i,(I_t\backslash Y_t)_i]$
1970-1989	0.1286 (0.0561)	0.4441† (0.2641)	0.2876	0.5363
1970-1979	0.1037 (0.0595)	0.6032 (0.2534)	0.4473	0.6688
1980-1989	0.1339 (0.0425)	0.3504* (0.2236)	0.2597	0.5096

* indicates that the coefficient β is insignificantly different from zero and significantly different from one at the 5% level of significance.
† indicates that the coefficient β is imprecisely estimated and differs insignificantly differ from zero and insignificantly from one at the 5% level of significance.

Standard errors are indicated in parentheses.

Source: OECD (1991), National Accounts of OECD Countries, Main Aggregates 1960-1989, Volume I.

In the period 1970-1989 β is imprecisely estimated. This is probably caused by the inclusion of Greece in the sample (see Obstfeld 1986, p. 71). The coefficient β is significantly different from zero and insignificantly different from one in the sub-period 1970-1979. We statistically speak of perfect capital immobility of type IV in the sub-period 1970-1979. The coefficient β is insignificantly different from zero and significantly different from one in the sub-period 1980-1989. We can statistically speak of perfect capital mobility of type IV in the sub-period 1980-1989 although it is questionable if all assumptions underlying the F-H test are met (see section 3.2). This result differs from the results obtained earlier by Feldstein and Bacchetta. The inclusion of three more years in the sample period results in a higher degree of capital mobility of type IV in the sub-period 1980-1989. The result is also illustrated in figure 2 by the greater dispersion of points around the 45°-line in the sub-period 1980-1989 relative to the sub-period 1970-1979. Presumably, the degree of capital mobility of type I and II has also increased. However, the actual test concerns the degree of capital mobility of type IV. It is therefore very difficult to infer from the F-H condition the degree of capital mobility of type I and II which we prefer. The interpretation of the results must be done with caution. In the next section we will examine this further.

3.2 The Feldstein-Horioka condition and time-series analysis

The F-H condition for testing the degree of financial integration with time-series data can be specified as follows:

$$(I_i/Y_i)_t = \alpha + \beta\ (S_i/Y_i)_t + \epsilon_t \qquad (3)$$

In table 3 the results of testing the degree of financial integration of EC member states with time-series data are summarized.

Table 3: The F-H condition and time-series analysis of twelve EC member states: $(I_i/Y_i)_t=\alpha+\beta(S_i/Y_i)_t+\epsilon_t$

Period (t)	α	β	R^2	DW	Cor[$(S_i\backslash Y_i)_t$,$(I_i\backslash Y_i)_t$]
Germany					
1970-1989	0.0428	0.7570	0.5282	0.3203	0.7268
	(0.0398)	(0.1686)			
1970-1979	-0.0103	1.0068	0.8908	1.5013	0.9438
	(0.0305)	(0.1246)			
1980-1989	0.1988	0.1988†	0.0032	0.8196	0.0569
	(0.0491)	(0.2159)			
UK					
1970-1989	0.1674	0.1125*	0.0106	0.6365	0.1028
	(0.0446)	(0.2564)			
1970-1979	0.2115	-0.0672	0.0151	2.1237	-0.1227
	(0.0348)	(0.1921)			
1980-1989	0.3932	-1.3160	0.3542	1.4884	-0.5952
	(0.1046)	(0.6283)			
France					
1970-1989	0.0288	0.8759	0.9242	1.7873	0.9613
	(0.0138)	(0.0591)			
1970-1979	0.0051	0.9641	0.7388	2.1148	0.8596
	(0.0526)	(0.2027)			
1980-1989	-0.0026	1.0343	0.8139	1.0859	0.9021
	(0.0356)	(0.1749)			
The Netherlands					
1970-1989	0.0270	0.8024	0.5437	0.5045	0.7374
	(0.0407)	(0.1733)			
1970-1979	0.0783	0.6318	0.5110	0.5578	0.7148
	(0.0540)	(0.2185)			
1980-1989	0.1365	0.2650†	0.1022	1.0890	0.3196
	(0.0616)	(0.2778)			
Italy					
1970-1989	0.0484	0.8134	0.6277	1.5003	0.7923
	(0.0354)	(0.1477)			
1970-1979	0.1048	0.5906†	0.0998	1.6021	0.3160
	(0.1630)	(0.6270)			
1980-1989	-0.0687	1.3579	0.8203	1.4364	0.9057
	(0.0490)	(0.2247)			
Belgium					
1970-1989	0.0642	0.6882‡	0.6886	0.5261	0.8298
	(0.0219)	(0.1091)			
1970-1979	0.1635	0.2768*	0.3162	1.7891	0.5623
	(0.0329)	(0.1439)			
1980-1989	0.1051	0.4077†	0.1872	0.5017	0.4326
	(0.0503)	(0.3003)			
Ireland					
1970-1989	0.1764	0.3581†	0.0461	0.4082	0.2147
	(0.0739)	(0.3841)			
1970-1979	0.3647	-0.4552†	0.0522	0.7022	-0.2286
	(0.1459)	(0.6855)			
1980-1989	0.5257	-1.8031*	0.3967	0.9513	-0.6298
	(0.1333)	(0.7861)			
Spain					
1970-1989	0.0200	0.9695	0.6346	0.7680	0.7966
	(0.0400)	(0.1734)			
1970-1979	0.1014	0.6580†	0.2489	0.8112	0.4989
	(0.1016)	(0.4042)			
1980-1989	0.0732	0.6959†	0.2202	0.4855	0.4693
	(0.0960)	(0.4630)			
Denmark					
1970-1989	0.0575	0.8528	0.8777	1.6886	0.9369
	(0.0136)	(0.0750)			
1970-1979	0.1099	0.6120‡	0.6910	2.6182	0.8313
	(0.0303)	(0.1447)			
1980-1989	0.0531	0.8662	0.5875	1.2872	0.7665
	(0.0380)	(0.2566)			
Portugal					
1970-1989	0.2467	0.1358*	0.0531	0.5638	0.2303
	(0.0343)	(0.1352)			
1970-1979	0.2492	0.1139*	0.2211	0.8388	0.4702
	(0.0205)	(0.0756)			
1980-1989	0.1906	0.3899†	0.0585	0.5017	0.2418
	(0.1300)	(0.5532)			
Greece					
1970-1989	0.0797	0.7750‡	0.9166	1.6390	0.9574
	(0.0126)	(0.0551)			
1970-1979	0.0144	1.0329	0.8818	1.7638	0.9390
	(0.0356)	(0.1337)			
1980-1989	0.1074	0.5991‡	0.8381	1.7001	0.9155
	(0.0170)	(0.0931)			
Luxemburg					
1970-1989	0.2834	-0.0701*	0.0767	1.3187	-0.2770
	(0.0293)	(0.0573)			
1970-1979	0.5227	-0.6460‡	0.4408	1.9036	-0.6639
	(0.1090)	(0.2572)			
1980-1989	0.3009	-0.0930*	0.1507	1.9987	-0.3881
	(0.0458)	(0.0781)			

* indicates that the coefficient β is insignificantly different from zero and significantly different from one at the 5% level of significance.
† indicates that the coefficient β is imprecisely estimated and differs insignificantly differ from zero and insignificantly from one at the 5% level of significance.
‡ indicates that the coefficient β is imprecisely estimated and differs significantly differ from zero and significantly from one at the 5% level of significance.

Standard errors are indicated in parentheses.

Source: OECD (1991), National Accounts of OECD Countries, Main Aggregates 1960-1989, Volume I.

Again the sample period 1970-1989 is divided into two sub-periods. We use t-statistics to be able to statistically examine the presence of perfect capital mobility of type IV between each EC member state and abroad. We simultaneously test the null hypothesis H_0: $\beta = 0$ against the alternative hypothesis H_1: $\beta \neq 0$ and the null hypothesis H_0: $\beta = 1$ against the alternative hypothesis H_1: $\beta \neq 1$. The coefficient β is insignificantly different from zero and significantly different from one in the following countries: Germany (1980-1989), the United Kingdom (1970-1989, 1970-1979, 1980-1989) the Netherlands (1980-1989), Belgium (1970-1979), Ireland (1980-1989), Portugal (1970-1989, 1970-1979) and Luxemburg (1970-1989, 1980-1989). We than statistically speak of perfect capital mobility of type IV. The empirical results seem consistent with an increasing degree of capital mobility of type IV in the 1980s.[10] However, the interpretation of the results must be done with caution. The criticism of the F-H condition is based on the three assumptions which must hold before no correlation between the savings and investment rate is to be expected. The three assumptions are repeated here and some comments are placed in a European context.

With reference to the first assumption: *Limited financial and or non-financial capital mobility, which means* $Cov(E(r_t - r_t^*), S_t/Y_t) \neq 0$. Ex ante PPP does not exist. The F-H condition is at the same time a criterion for financial integration and for real integration. It is very difficult to infer from the F-H results something about the degree of capital mobility of type I or II because restrictions on labour mobility, physical capital mobility or on trade in goods and services markets cause positive correlation between the savings and investment rate. It is also important to stress that investment and savings decisions are based on ex ante real interest rates. But, the F-H condition examines with ex post data ex ante (net) capital mobility invoked by changes in expected real rates. The ex post calculation of capital mobility is merely an approximation of ex ante capital mobility. Another disadvantage of the F-H condition is that it examines purely *net* financial and non-financial capital mobility. *Gross* financial and non-financial capital mobility may well be higher. We quote Golub (1990, p. 427): '[...] low *ex post* net international capital flows cannot necessarily be interpreted

[10] Some evidence of increasing perfect capital mobility of type IV in the 1980s relative to the 1970s is ambiguous, since the regression coefficient of the savings rate against the investment rate falls while the coefficient of determination rises.

as indicating low *ex ante* capital mobility.' Net capital flows may be lower than gross capital flows and hence masks the degree of financial integration. Furthermore, the F-H condition not only measures the degree of capital mobility of type IV between EC member states but also between EC member states and abroad which of course also includes countries like the United States and Japan. On the other hand, however, De Boissieu (1988) argues: 'Financial deregulation will generate a more efficient allocation of capital in European countries. It is likely that a portion of loanable funds invested abroad, particularly in the United States and Switzerland, will be kept within EC countries after lifting of exchange controls.' Besides, The F-H condition is also more indicative of capital market integration than of money market integration. Investment and savings decisions are usually made with a fairly long time horizon. An advantage of the F-H condition is that it considers all (long-term) capital flows that result from trade in shares and in (long-term) bonds. An interest parity condition only considers a segment of a financial market which corresponds to bonds with a specific maturity.

With reference to the second assumption: *The foreign expected real interest rate is endogenous, which means* $Cov(E(r_t^*), S_t/Y_t) \neq 0$. Harberger (1980) and Murphy (1984) argued that the correlation between savings and investment will increase with country size. Small countries take the world interest rate as given, while changes in savings and investment behaviour of large countries will have an impact on the world interest rate (Tesar 1991, p. 68). When a fall in national savings in a country is large enough to affect world financial market conditions the expected real world interest rates will rise and crowd out some investment of the world and of the country in question.[11] This argument is particular relevant in time-series studies and may present a problem in the European context. This is one reason why the degree of capital mobility of type III is probably higher for certain countries such as Germany, France and Italy than the degree of capital mobility of type IV. Harberger argues that in small unidirectional countries savings and investment shocks do not compensate each other while in large diversified countries this does happen. Differences between savings and investment are therefore greater in small than in large countries. These greater differences,

[11] Large countries are countries with a large share of world output and likely have a large share in world's total savings and investment.

however, do not mean that the degree of capital mobility of type IV is higher.

With reference to the third assumption: *S_t and I_t are endogenous, which means $Cov(\mu_i, S_t/Y_t) \neq 0$*. Does the equation $(I_i/Y_i)_t=\alpha+\beta(S_i/Y_i)_t+\epsilon_t$ represent the correct model of financial integration? Table 3 includes the Durbin-Watson statistic. We test the null hypothesis that no serial correlation is present (H_o: $\rho = 0$) against the alternative hypothesis that positive or negative serial correlations are present (H_i: $\rho \neq 0$). Table 3 shows that the equation $(I_i/Y_i)_t=\alpha+\beta(S_i/Y_i)_t+\epsilon_t$ is not always for every country and for every period the correct model because of positive serial correlation. The exclusion of important independent variables will cause positive serial correlation.[12] However, introducing new variables would frustrate the essence of the F-H condition which is based on an accounting framework. On the other hand, it is this accounting framework and the lack of a good structural underlying model in which the relationships between savings, investment and capital mobility are specified which presents a serious problem (Mishkin 1986, p. 70). Positive serial correlation together with OLS underestimates standard deviations and thus overestimates t-statistics. We erroneously tend towards rejecting the null hypotheses while the null hypotheses are true. Thus, for example, Spain and Portugal show structural positive serial correlation for each period considered. This may be explained by the extreme thinness of their financial markets. Positive serial correlation may also cause imprecise estimates of the coefficient ß. The problem of serial correlation is also closely connected with the endogeneity problem in cross-section and especially in time-series analysis. Even with perfect capital mobility of type III savings and investment rates will be positively correlated for reasons unrelated to capital mobility, such as business cycles, population growth and productivity growth. Quoting Dooley et al. (1987, p. 508): '*Any* economic variable, in addition to the cost of capital that influences the investment rate [that means μ_i], will probably be correlated with the national savings rate.' Not only private sector behaviour but also public sector behaviour may cause savings and investment rates to be positively correlated. For example, positive correlation obtains when a government - which aims at long-term current account balance - reacts to a current

[12] The exclusion of important variables also causes low determination coefficients and low simple correlation coefficients.

account deficit caused by growing investment with raising taxes or lowering their spending (see Westphal 1983, Summers 1988). Endogenous savings and investment make the use of OLS inappropriate. An econometric solution to the endogeneity problem is offered by the use of instrumental variables. However the results of these 2SLS-estimates do not particularly differ from OLS-estimates because it is difficult to identify suitable instruments (see for example Feldstein and Horioka 1980, p. 323-327, Dooley et al. 1987, p. 514-518, p. 1084-1087, Frankel 1989, p. 9-13 and Bayoumi 1990, p. 369-370).

Summing up, above problems make the F-H condition less suitable for measuring the degree of financial integration. The next section of this paper, therefore, focuses on the price approach.

4 THE PRICE APPROACH

4.1 Money market integration

Short-term interest correlations

In section 3 we concluded that the F-H condition is less suitable for measuring the degree of financial integration. This section focuses on the price approach. The price approach stresses that price convergence and parallel price development are important manifestations of financial integration. Common criteria for examining price convergence are interest parity conditions. Common criteria for examining parallel price developments are correlation coefficients. Firstly, we examine money market integration and calculate the correlation coefficients between representative money market interest rates of EC member states.[13] The monthly data used are nominal short-term interest rates which are considered representative of the money market situation in EC member states by international institutions such as the OECD and the IMF (see data appendix).[14] Financial integration will cause close linkages between representative nominal short-term interest rates of EC member states. Murray and Khemani (1990, p. 13) argue: ' (...) neither covered interest parity

[13] With the reservation of data availability.

[14] Quoting the OECD (1990c, p. 45) the 'Methodological Supplement' to 'OECD Financial Statistics Monthly': ' (...) the aim has not necessarily been to take the same rate for all countries, but to choose the rates which are the most typical or the most revealing, or again, those which may be described as the 'reference' rates. In drawing up the following norms, while attention has, of course, been given to ensuring as much international comparability as possible, it has nevertheless been necessary to have regard for the fact that the methods of calculation used by countries to some extent reflect the institutional features of their financial markets.'

nor uncovered interest parity requires foreign and domestic interest rates to move in a lock-step fashion, though a closer relationship might be expected between the rates than would exist if foreign and domestic capital markets were completely segmented.'

Table 4a: Correlations among representative nominal short-term interest rates of EC member states during the period January 1981 to December 1990 (excluding Portugal and Luxemburg)

	Ger	UK	Fra	NL	Ita	Bel	Ire	Spa	Den	Gre
Ger	1.0000									
UK	0.6735	1.0000								
Fra	0.7794	0.3152	1.0000							
NL	0.9618	0.7325	0.7233	1.0000						
Ita	0.5608	0.1144	0.8747	0.4805	1.0000					
Bel	0.8245	0.3957	0.9286	0.7557	0.8893	1.0000				
Irl	0.5763	0.2772	0.8078	0.5551	0.8382	0.8397	1.0000			
Spa	0.2946	-0.0456	0.5246	0.2439	0.4365	0.3380	0.3183	1.0000		
Den	0.5552	0.1740	0.7283	0.4720	0.6288	0.7187	0.6416	0.2917	1.0000	
Gre	0.3699	0.4296	0.1443	0.4046	0.1194	0.2606	0.2539	-0.0978	0.1223	1.0000

Note: Correlation Greece during the period January 1982 to December 1990. For Portugal no data were available.

Source: see data appendix.

Table 4b: Correlations among representative nominal short-term interest rates of EC member states during the period January 1981 to December 1985 (excluding Portugal and Luxemburg)

	Ger	UK	Fra	NL	Ita	Bel	Ire	Spa	Den	Gre
Ger	1.0000									
UK	0.6606	1.0000								
Fra	0.7951	0.4505	1.0000							
NL	0.9548	0.7638	0.7617	1.0000						
Ita	0.6762	0.3328	0.8903	0.5788	1.0000					
Bel	0.8845	0.5751	0.8521	0.8084	0.8295	1.0000				
Ire	0.6362	0.5953	0.7915	0.6069	0.8657	0.7922	1.0000			
Spa	0.0807	-0.3079	0.3866	0.0038	0.4715	0.0600	0.1389	1.0000		
Den	0.4698	0.2320	0.6126	0.3622	0.5864	0.6132	0.5019	0.0640	1.0000	
Gre	0.5420	0.5525	0.4800	0.5396	0.4398	0.5469	0.6074	-0.1027	0.2666	1.0000

Note: Correlation Greece during the period January 1982 to December 1985. For Portugal no data were available.

Source: see data appendix

Table 4c: Correlations among representative nominal short-term interest rates of EC member states during the period January 1986 to December 1990 (excluding Luxemburg)

	Ger	UK	Fra	NL	Ita	Bel	Ire	Spa	Den	Por	Gre
Ger	1.0000										
UK	0.9297	1.0000									
Fra	0.8619	0.8277	1.0000								
NL	0.9760	0.9103	0.8775	1.0000							
Ita	0.1941	0.3641	0.2047	0.2570	1.0000						
Bel	0.8263	0.8739	0.8095	0.8686	0.6244	1.0000					
Ire	0.1571	0.2629	0.2387	0.2847	0.4432	0.4897	1.0000				
Spa	0.3817	0.2913	0.4930	0.4720	-0.1105	0.2580	0.0527	1.0000			
Den	0.5038	0.4114	0.6639	0.6104	0.0381	0.5514	0.5429	0.5051	1.0000		
Por	0.6810	0.6943	0.6923	0.7458	0.5808	0.8739	0.5821	0.2711	0.5840	1.0000	
Gre	0.3225	0.3585	0.2034	0.3418	0.4236	0.4463	0.2496	-0.0334	0.1297	0.3835	1.0000

Source: see data appendix

Table 4a shows cross-correlation coefficients between EC member states during the period January 1981 to December 1990. Tables 4b

and 4c show cross correlations during the equal sub-periods: January 1981 to December 1985 and January 1986 to December 1990. Luxemburg is excluded from the sample because Luxemburg and Belgium form a monetary union.

A useful way of examining the degree of financial integration between EC member states is to compare their correlation coefficients with Germany because Germany forms the anchor of the European Monetary System (EMS). The correlation coefficient between the Netherlands and Germany is very high. Also the short-term interest rate in Belgium, France and the United Kingdom shows a high correlation with that in Germany. The correlation coefficients of Ireland, Denmark, Italy, Greece, Spain and Portugal with respect to Germany are lower.

Intuitively, we might expect countries with open financial markets to show relatively high correlation coefficients. As can be seen in table 4a the correlation coefficient between countries with open money markets is relatively high (Germany, the Netherlands, Belgium, France and the United Kingdom). The correlation coefficients between countries with closed money markets and between those and countries with open money markets are relatively low (Italy, Denmark, Greece, Ireland, Spain and Portugal).

The correlation coefficients in the sub-period January 1986 to December 1990 are generally somewhat higher than the correlation coefficients in the sub-period January 1981 to December 1985. An explanation for this result is the lifting of capital controls. The period January 1986 to December 1990 incorporates the directive of 24 June 1988 when the European Commission stated that from 1 July 1990 all short-term and long-term capital movements in the EC are to be free of restrictions. In practice this meant that especially restrictions on short-term capital movements had to disappear (many restrictions on long-term capital movements were already lifted earlier). However, Greece, Ireland, Spain and Portugal do not have to fulfil this directive until 31 December 1992. Moreover, Portugal and Greece have the possibility to postpone implementation of this directive till 31 December 1995.

Of course, correlation coefficients must be interpreted very carefully. Not all of the synchronous movement of interest rates can be attributed to integration of financial markets. The linkages between interest rates depend for a large part on the form of the exchange rate regime and the way in which exchange rate expectations are formed. In the

EMS with stable exchange rates, there is a presupposition that increased capital mobility will induce interest rates to move closely together.[15] High correlation coefficients may represent the convergence of monetary policies in the 1980s or, more precisely, the convergence of monetary policy objectives in the EC. Monetary policies were used intensively to fight inflation in most of the industrial countries and may cause interest rates to move together. Dutch monetary authorities, for example, use the nominal short-term interest rate as an policy instrument to maintain a stable exchange rate with respect to the DM.[16] Furthermore, high correlation coefficients may represent convergence in the nature of the information sets used by separate national investors, reflecting lower and more similar inflation rates and a commonality of other shocks (Kenen 1990, p. 51). High correlation coefficients could also be provoked by economic agents reacting to the same news.

Short-term interest differentials

Table 5, calculated on the basis of Frankel (1989) by the European Commission (1990, p. 160) examines all four types of capital mobility which were presented in table 1. Table 5 examines if the CIP, the UIP and the RIP condition hold between EC member states and Germany. The mean deviation from (ex post) real interest parity is decomposed into a country premium, an exchange risk premium and a deviation from relative purchasing power parity for the EC countries relative to Germany during the period September 1982 to April 1988.[17] Ideally, each of these factors should be zero for perfect capital mobility (of a particular type) to hold. Price expectations and exchange rate expectations have been proxied by their observed values on the basis of rational expectations (ex ante variables become ex post variables). The European Commission transforms the mean deviation from *ex post* real interest parity relative to the United States (and their components) that was calculated by Frankel (1989) in the following way: $r-r_{Ger}=r-r_{US}-(r_{Ger}-r_{US})$. By doing so we obtain the mean deviation from ex post real interest parity relative to Germany.

[15] EC member states which participate in the Exchange Rate Mechanism of the EMS are: Belgium, Denmark, Germany, France, Ireland, Italy, France, the Netherlands and Luxemburg (as of 13 March 1979), Spain (as of 16 June 1989) and the United Kingdom (as of 8 October 1990). Belgium, Denmark, Germany, France, Ireland, the Netherlands and Luxemburg have a fluctuation margin of ± 2.25%, Italy ± 6% and as of 8 January 1990 ± 2.25%, Spain and the United Kingdom ± 6%.

[16] The nominal long-term interest rate is not an instrument of monetary policy. Capital markets are more dominated by market forces.

[17] Frankel and MacArthur (1988) first introduced the decomposition method of real interest differentials.

Table 5: Ex post measures of short-term capital mobility of EC member states relative to Germany, averages of monthly observations during the period September 1982 to April 1988[18]

	Covered nominal interest parity (CIP) (1)	Exchange risk premium (2)	Uncovered nominal interest parity (UIP) (3)=(1)+(2)	Relative PPP deviation (4)	Currency premium (5)=(2)+(4)	Real interest parity (RIP) (6)=(1)+(5)
Belgium	-0.23	3.40	3.17	-1.34	2.08	1.82
Denmark	-3.88	3.39	-0.49	-1.59	1.80	-2.13
Greece	-9.74	-0.47	-10.21	4.53	2.49	-7.93
Spain	-2.75	4.87	2.12	0.34	4.78	1.82
France	-2.09	3.36	1.27	0.11	3.01	0.81
Ireland	-1.14	3.16	2.02	0.50	3.80	2.82
Italy	-0.75	4.66	3.91	-1.66	3.08	2.30
The Netherlands	-0.14	0.24	0.10	0.24	0.74	0.58
Portugal	-8.28	7.16	-1.12	-1.77	6.60	-2.61
United Kingdom	-0.49	-0.34	-0.83	3.51	2.27	1.75

(1) $i_t - i_t^* - fd_t$
(2) $fd_t - \Delta s_t^e$
(3) $i_t - i_t^* - \Delta s_t^e$
(4) $\Delta s_t^e - (p_t - p_t^*)$
(5) $fd_t - (p_t - p_t^*)$
(6) $i_t - p_t - (i_t^* - p_t^*)$

with:

fd_t = three-month forward discount with respect to the DM.
Δs_t^e = observed depreciation with respect to DM (proxy for expected value), three month percentage change at annual rate.
p_t = observed inflation(proxy for expected value) over three-month period at annual rate.
i_t = money market interest rate over three-month period.
$^*_t$ = refers to German variables.

Note: The identities (6)=(1)+(5) and (5)=(2)+(4) are not always respected due to inconsistencies in the original data material.

Source: Calculated from Frankel (1989) by the European Commission (1990, p. 160).

The least stringent criterion by which to judge the degree of financial integration is the CIP condition (1). If we examine the capital mobility of type I (or II and III) we assume that there are no domestic distinctions among the assets (D_t=0). The covered nominal interest differential relative to Germany (i_t-i_t^*-fd_t) reflects the country premium.[19] A negative country premium means that domestic interest rate is artificially low compared to the German interest rate and barriers exist to discourage capital exports into the other EC country. According to table 5 only the United Kingdom, the Netherlands and Belgium have small country premiums of not more than 50 basis points, reflecting probably only transaction costs. Greece and Portugal show high country premiums and clearly maintained many capital controls. A stronger criterion than the CIP condition by which to judge the degree of financial integration is the UIP condition (3). According to table 5 the smallest ex post uncovered nominal interest differential relative to Germany is that of the Netherlands. This points to high money market integration between the Netherlands and Germany. Also the ex post uncovered nominal interest differential of the United Kingdom relative to Germany is small. Deviations from ex post UIP may reflect a risk premium or irrational forecasts. De Boissieu

[18] Some of the original calculations of the European Commission (1990, p. 160) have been corrected. The exchange risk premium of France is 3.36 in stead of 3.35 and the exchange risk premium of the Netherlands is 0.24 instead of 0.26. Relative PPP deviation of the Netherlands is 0.24 instead of 0.26. The currency premium of Ireland is 3.80 instead of 4.80. Calculations of interest parity conditions are based on pre-tax returns.

[19] A recent status of capital controls in EC member states can be found in Kredietbank (1990). See also OECD (1990a) and OECD (1990b).

(1988, p. 59) says about deviations from ex post UIP: '(...) the inability of operators to forecast accurately the date and the extent of realignments may explain differences in the *ex post* returns on financial assets with the same maturity denominated in different currencies.' The RIP condition (6) is stronger than the UIP condition (3). According the RIP condition perfect capital mobility of type III could only be said to exist between Germany and the Netherlands.

Of course it could be hazardous to measure the degree of money market integration by only looking at a few segments of domestic and foreign money markets. We consequently use another criterion which partially avoids this problem. Another criterion which can be used to measure the degree of money market integration is simply to calculate the nominal short-term interest differential. This interest differential is used as a approximation of the short-term ex ante uncovered nominal interest differential and assumes $\Delta s_t^e=0$.[20] This approximation may be warranted for EC countries which participate in the Exchange Rate Mechanism (ERM) of the EMS. Although some exchange rates of EMS countries are within a small band, the possibility of an exchange rate realignment in the EMS, always influences nominal exchange rate expectations which cause nominal short-term (and long-term) interest rate divergences.

Table 6 shows the means and standard deviations of nominal short-term interest differentials of EC member states with respect to Germany during the period January 1981 to December 1990 and the sub-periods January 1981 to December 1985 and January 1986 to December 1990.

Table 6: Nominal short-term interest differentials of EC member states relative to Germany (excluding Luxemburg): means and standard deviations

	1981-1990	1981-1985	1986-1990
UK-Germany	5.13%	4.06%	6.20%
	(1.89)	(2.01)	(0.88)
France-Germany	4.08%	5.16%	3.01%
	(1.75)	(1.63)	(1.05)
Netherlands-Germany	0.29%	-0.03%	0.61%
	(0.75)	(0.82)	(0.49)
Italy-Germany	8.34%	10.37%	6.32%
	(2.86)	(1.97)	(2.08)
Belgium-Germany	3.44%	4.54%	2.33%
	(1.60)	(1.25)	(1.07)
Denmark-Germany	4.65%	5.32%	3.99%
	(2.77)	(3.44)	(1.60)
Ireland-Germany	5.17%	6.13%	4.21%
	(2.49)	(2.16)	(2.41)
Spain-Germany	8.20%	8.27%	8.14%
	(3.16)	(3.86)	(2.23)
Portugal-Germany	-	-	7.72%
			(2.54)
Greece-Germany	11.77%[1]	10.95%[2]	12.43%
	(3.15)	(2.67)	(3.34)

[1] During the period January 1982 to December 1990
[2] During the period January 1982 to December 1985

Source: see data appendix

[20] De Haan et al.(1991a) have shown that this assumption is probably not warranted.

The nominal short-term interest differential of non-EMS countries (Greece and Portugal) and the nominal short-term interest differential of EMS countries with a broader band (Italy, Spain and the United Kingdom) is significant. EMS countries with a smaller fluctuation margin in general have a smaller differential. The Netherlands has the smallest differential with respect to Germany.

The interpreation of the nominal short-term interest differential must be done with caution. In the ERM of the EMS short-term interest are also used as policy instruments to keep exchange rates wihtin the bands of the EMS. Fukao en Hanazaki (1987, p. 75) argue: 'Under an actual adjustable peg system such as the EMS, the nominal interest rates are not equalised in the short run. This divergence of interest rates is due to the allowed margin of movements in the exchange rates and possible future changes in the parity rates. We can tautologically decompose the causes of nominal interest rate divergences as follows: $i_t - i_t^* = (i_t - i_t^* - fd_t) + (fd_t - \Delta s_t^e) + \Delta s_t^e$. Growing exchange rate fluctuations influence the last two factors. This most certainly explains why the United Kingdom is not well integrated by this criterion while it is well integrated by the UIP condition.

In table 6 we also examine changes in the degree of money market integration of EC member states by comparing the nominal interest differential of the sub-period January 1981 to December 1985 with the sub-period January 1986 to December 1990. The interest differential decreased for France, Italy, Belgium, Denmark, Ireland and Spain. Just as we expected, these countries recently abolished their capital controls on short-term capital movements. Furthermore, the standard deviation of the nominal short-term interest differential declined in all EC countries except Italy and Greece.

4.2 Capital market integration

Long-term interest correlations

Tables 7a, 7b and 7c show cross-correlation coefficients between EC member states during the period January 1981 to December 1990 and during the sub-periods January 1981 to December 1990 and January 1986 to December 1990. The monthly data are representative nominal long-term interest rates based on government bonds traded in the secondary market.

Table 7a: Correlations among representative nominal long-term interest rates of EC member states during the period January 1981 to December 1990

	Ger	UK	Fra	NL	Ita	Bel	Ire	Spa	Den	Por	Gre	Lux
Ger	1.0000											
UK	0.8695	1.0000										
Fra	0.7954	0.8138	1.0000									
NL	0.9769	0.9153	0.8527	1.0000								
Ita	0.7572	0.7802	0.9591	0.8284	1.0000							
Bel	0.8632	0.8271	0.9529	0.8955	0.9331	1.0000						
Ire	0.6909	0.8372	0.9171	0.7618	0.8668	0.8655	1.0000					
Spa	0.7291	0.5062	0.7750	0.7173	0.7642	0.8064	0.5857	1.0000				
Den	0.7546	0.8250	0.9210	0.8298	0.8954	0.8781	0.9088	0.6238	1.0000			
Por	0.2200	0.1581	0.4774	0.2244	0.4533	0.5110	0.4464	0.5680	0.2391	1.0000		
Gre	0.1570	-0.0719	0.0976	0.0839	0.0176	0.0763	0.0831	0.3156	-0.0442	0.2686	1.0000	
Lux	0.4046	0.3945	0.6981	0.4480	0.7197	0.7129	0.6721	0.6152	0.6106	0.6922	0.0297	1.0000

Note: Correlations of Greece with EC member states during the period January 1982 to December 1988.

Source: see data appendix

Table 7b: Correlations among representative nominal long-term interest rates of EC member states during the period January 1981 to December 1985

	Ger	UK	Fra	NL	Ita	Bel	Ire	Spa	Den	Por	Gre	Lux
Ger	1.0000											
UK	0.8751	1.0000										
Fra	0.8854	0.7857	1.0000									
NL	0.9767	0.9074	0.8998	1.0000								
Ita	0.7559	0.6873	0.9331	0.7913	1.0000							
Bel	0.9017	0.8285	0.9237	0.8986	0.8152	1.0000						
Ire	0.8501	0.8826	0.8307	0.8560	0.7641	0.9123	1.0000					
Spa	0.3898	0.0525	0.4662	0.3272	0.4615	0.3901	0.2459	1.0000				
Den	0.8007	0.7613	0.9024	0.8320	0.8518	0.9228	0.8715	0.2967	1.0000			
Por	-0.6380	-0.7021	-0.7570	-0.7128	-0.7399	-0.7385	-0.6471	-0.0256	-0.7998	1.0000		
Gre	0.2563	-0.1115	-0.0050	0.0804	-0.0680	0.0922	0.0423	0.5041	-0.2353	0.4111	1.0000	
Lux	-0.3496	-0.3710	-0.0251	-0.3367	0.1056	-0.0555	-0.0445	0.1540	0.0892	0.1050	-0.1746	1.0000

Note: Correlations of Greece with EC member states during the period January 1982 to December 1985.

Source: see data appendix

Table 7c: Correlations among representative nominal long-term interest rates of EC member states during the period January 1986 to December 1990

	Ger	UK	Fra	NL	Ita	Bel	Ire	Spa	Den	Por	Gre	Lux
Ger	1.0000											
UK	0.7969	1.0000										
Fra	0.5242	0.5571	1.0000									
NL	0.9839	0.7903	0.5303	1.0000								
Ita	0.4617	0.4000	0.2836	0.5495	1.0000							
Bel	0.9047	0.7339	0.5665	0.9356	0.7020	1.0000						
Ire	-0.1692	0.3275	0.3584	-0.1709	-0.2772	-0.2189	1.0000					
Spa	0.7558	0.4420	0.5560	0.7924	0.5651	0.7718	-0.3554	1.0000				
Den	0.1793	0.3186	0.5796	0.2017	-0.1652	0.1335	0.6481	0.1691	1.0000			
Por	0.1105	0.1995	0.2543	0.2400	0.5735	0.2862	0.0759	0.2878	0.1602	1.0000		
Gre	-0.2192	-0.3806	0.1827	-0.3066	-0.2508	-0.3335	-0.0016	0.2239	0.3410	0.1680	1.0000	
Lux	0.2570	0.4669	0.3093	0.3555	0.4767	0.3801	0.3552	0.1374	0.3146	0.6891	-0.0081	1.0000

Note: Correlations of Greece with EC member states during the period January 1986 to December 1988.

Source: See data appendix

In the period January 1981 to December 1990 the Netherlands has the highest correlation coefficient with respect to Germany. The Netherlands is followed by Belgium, the United Kingdom and France. France is included in the group of countries with high capital market

integration. According to the F-H condition France has a less open capital market. Also Ireland, Denmark, Italy and Spain show a high correlation with respect to Germany. Portugal, Greece and Luxemburg show a lower correlation with respect to Germany.

We also examine changes in the degree of capital market integration of EC member states by comparing the correlation coefficients in the sub-period January 1981 to December 1985 with the sub-period January 1986 to December 1990. In general, the correlation coefficients are higher in the second sub-period.

Correlations among representative nominal long-term interest rates of EC countries seem higher than among representative nominal short-term interest rates. This result is an indication of greater capital market integration than money market integration in the EC, which is remarkable. Kasman and Pigott (1987a, p. 263) argue: '(...) because economic uncertainties tend to increase with the time horizon, risk factors are very likely to be of greater importance in longer-term relative to shorter-term asset returns.' Especially currency risk is expected to rise when long-term assets are used because the currency exposure of long-term assets cannot be covered in the forward market. These considerations suggest that capital mobility is significantly lower for capital market as opposed to money market instruments. An explanation for our remarkable result is that the liberalization of long-term capital movements started earlier than the liberalisation of short-term capital movements. The liberalisation of long-term capital movements started as early as 17 November 1986 when the European Commission enacted a directive to lift all restrictions on long-term capital movements. The directive to lift all restrictions on short-term capital movements was enacted on 24 June 1988. This means that as of 1 July 1990 the first phase of the European Economic and Monetary Union (EMU) was started. Of course the same problems as before are connected to analyzing correlation coefficients between long-term interest rates. A new problem is the question how to measure the degree of capital market integration without looking to stock markets. When the stock market integration is much smaller we would mistakenly conclude that capital market integration had risen.

Long-term interest differentials

Table 8 shows the means and standard deviations of nominal long-term interest differentials of EC member states with respect to Germany.

Now we examine capital market integration. Kneeshaw and Van den Bergh (1985, p. 38) argue: '(...) if markets are integrated internationally and long-term interest arbitrage conditions can be assumed to hold (i.e., that over the relevant time horizon the expectations operating in different markets are consistent) domestic long-term bonds will be priced in a way which allows differentials vis-à-vis foreign yields to reflect expected exchange rate changes (and, perhaps, a risk premium).'

Table 8: Nominal long-term interest differentials of EC member states relative to Germany: means and standard deviations

	1981-1990	1981-1985	1986-1990
UK-Germany	3.22%	3.52%	2.93%
	(0.89)	(1.01)	(0.62)
France-Germany	4.32%	5.95%	2.68%
	(1.87)	(0.92)	(0.90)
Netherlands-Germany	0.41%	0.73%	0.08%
	(0.52)	(0.54)	(0.19)
Italy-Germany	6.64%	9.01%	4.27%
	(2.82)	(1.90)	(1.00)
Belgium-Germany	2.70%	3.89%	1.51%
	(1.29)	(0.54)	(0.44)
Denmark-Germany	5.41%	7.44%	3.37%
	(2.99)	(2.86)	(1.20)
Ireland-Germany	4.94%	6.67%	3.22%
	(2.31)	(1.28)	(1.77)
Spain-Germany	6.61%	7.29%	5.93%
	(1.39)	(1.44)	(0.93)
Portugal-Germany	9.24%	10.56%	7.92%
	(2.70)	(3.10)	(1.22)
Greece-Germany	9.55%[1]	8.97%[2]	10.32%[3]
	(2.14)	(2.01)	(2.05)
Luxemburg-Germany	1.18%	1.32%	1.04%
	(1.34)	(1.55)	(1.07)

[1] During the period January 1982 to December 1988
[2] During the period January 1982 to December 1985
[3] During the period January 1986 to December 1988

Source: see data appendix.

The Netherlands has the smallest nominal long-term interest differential with respect to Germany during the period January 1981 to December 1990, followed by Luxemburg, Belgium, the United Kingdom, France, Ireland, Denmark, Spain, Italy, Portugal and Greece. Countries with a narrow band have lower nominal long-term interest differentials than those countries with a broad band.

In table 8 we also examine changes in the degree of capital market integration of EC member states by comparing the nominal long-term interest differential in the sub-period January 1981 to December 1985 with the sub-period January 1986 to December 1990. The nominal long-term interest differential has unambiguously fallen. Capital market integration has considerably risen in the EC. Furthermore, the standard deviation of the nominal long-term interest differential declined in all EC countries except Ireland and Greece.

Moreover, it seems that capital market integration is higher than money market integration. Of course, this conclusion depends on the convergence of monetary policies in the EC. High nominal short-term

interest differentials may also be explained by the use of the nominal short-term interest rate as a policy instrument to maintain the exchange rates in the allowed fluctuation margins of the EMS. Although the interpretation of the nominal short-term interest differential highly depends on the degree of convergence of monetary policies in the EC, the calculations of correlation coefficients and nominal interest differentials always point to higher capital market integration than money market integration.

5. CONCLUSIONS

This paper analyses in a theoretical and empirical manner the degree of financial integration in the EC. Defining the concept of financial integration was important because the criteria within the quantity and the price approach measure different types of capital mobility. To obtain a more comprehensive perspective on the overall degree of financial integration in the EC and how this is changing over time we used four criteria which differ with respect to their underlying assumptions.

Although the criteria do not always give the same answers, on the whole, it can be said that the degree of money and capital market integration in the EC has increased in the 1980s. Moreover - in our research - the different criteria in general point to the same classification of EC member states which are more or less integrated. The financial markets of Germany, the United Kingdom, Luxemburg and the Netherlands are most integrated. This group is closely followed by Belgium, France, Denmark, Ireland and Italy. Spain, Portugal and Greece have the least integrated financial markets.

APPENDIX

DATA SOURCES

Gross national savings, gross domestic investment and gross domestic product

Data of gross national savings (S_t), gross domestic investment (I_t) and gross domestic product (Y_t) are taken from OECD (1991), National Accounts of OECD Countries, Main Aggregates 1960-1989, Volume I. Gross domestic investment or 'gross capital formation' is the sum of 'gross fixed capital formation' and 'increase in stocks'. Gross national savings is the sum of 'net saving' and 'consumption of fixed capital'. Adding up gross national savings and the 'surplus of the nation on current transactions' results apart from a 'statistical discrepancy' in 'finance of gross capital formation.' Gross domestic investment is financed by gross national savings and the surplus of the nation's current account. The 'statistical discrepancy' is actually assigned to the surplus of the current account of the balance of payments. Gross domestic product is taken at current prices (Y). OECD-calculations of S_t, I_t and Y_t of all EC member states except Greece are based on definitions of the Present System of National Account (S.N.A.) of the United Nations. Calculations of Greece are based on an earlier system.

Representative nominal short-term interest rates
The table summarizes the data of the representative nominal short-term interest rates of EC member states.

Country	Period	Description	Source
Germany	1/1981-12/1985	3-month interbank loans	OECD Financial Statistics Monthly
	1/1986-12/1990	3-month fibor	OECD Financial Statistics Monthly
UK	1/1981-12/1990	3-month interbank loans	OECD Financial Statistics Monthly
France	1/1981-12/1988	3-month pibor	OECD Main Economic Indicators, Historical Statistics 1969-1988
	1/1989-12/1990	3-month pibor	OECD Financial Statistics Monthly
The Netherlands	1/1981-12/1990	3-month loans to local authorities	OECD Financial Statistics Monthly
Italy	1/1981-12/1990	Interbank sight deposits	OECD Financial Statistics Monthly
Belgium	1/1981-12/1990	3-month treasury certificates	OECD Financial Statistics Monthly
Ireland	1/1981-12/1990	3-month treasury bills	OECD Main Economic Indicators
Spain	1/1981-12/1981	3-month interbank loans	OECD Main Economic Indicators, Historical Statistics 1969-1988
	1/1982-12/1990	3-month interbank loans	OECD Financial Statistics Monthly
Denmark	1/1981-12/1985	call money	Comite des Gouverneurs/Koers-lijstje, IFS Call money
	1/1986-10/1988	3-month interbank rate	Idem
	11/1988-12/1990	3-month eurorate	Idem
Portugal	1/1986-12/1990	Money market rate	IMF International Financial Statistics
Greece	1/1982-12/1986	Rate on 3-month treasury bills	Various supplement A of the periodical European Economy, data source EUROSTAT
	1/1987-12/1990	Rate on 3-month treasury bills	EUROSTAT Eurostatistics, data for short term economic analysis

Representative nominal long-term interest rates
The table summarizes the data of the representative nominal long-term interest rates of EC member states. All long-term government bonds are traded on the secondary market.

Country	Period	Description	Source
Germany	1/1981-12/1990	7-15 year public sector bonds	OECD Financial Statistics Monthly
UK	1/1981-12/1990	20 year central government bonds	OECD Financial Statistics Monthly
France	1/1981-12/1990	Public and semi-public sector bonds	OECD Financial Statistics Monthly
The Netherlands	1/1981- 1/1984	Latest three long-term issues of central government bonds	OECD Financial Statistics Monthly
	2/1984-12/1990	5 longest running issues of central government bonds	OECD Financial Statistics Monthly
Italy	1/1981-12/1990	Treasury bonds with life between 2 & 3 years	OECD Financial Statistics Monthly
Belgium	1/1981-12/1990	Central government bonds	OECD Financial Statistics Monthly
Ireland	1/1981-12/1990	Government bonds (more than 5 years)	OECD Main Economic Indicators
Spain	1/1981-12/1983	Government bonds (more than 2 years)	OECD Main Economic Indicators, Historical Statistics 1969-1988
	1/1984-12/1990	Government bonds (more than 2 years)	OECD Financial Statistics Monthly
Denmark	1/1981-12/1990	Central government 4,5% bonds	OECD Financial Statistics Monthly
Portugal	1/1981-12/1990	Government bond yield	IMF, IFS-databank
Greece	1/1982- 9/1984	Yield on a fixed interest government bond	Various supplement A of the periodical European Economy, data source EUROSTAT
	10/1984-12/1988	Yield on a fixed interest government bond	EUROSTAT Eurostatistics, data for short term economic analysis
Luxemburg	1/1981-12/1990	Government bond yield	IMF, International Financial Statistics

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IN 1991 REEDS VERSCHENEN

466 Prof.Dr. Th.C.M.J. van de Klundert - Prof.Dr. A.B.T.M. van Schaik
Economische groei in Nederland in een internationaal perspectief

467 Dr. Sylvester C.W. Eijffinger
The convergence of monetary policy - Germany and France as an example

468 E. Nijssen
Strategisch gedrag, planning en prestatie. Een inductieve studie binnen de computerbranche

469 Anne van den Nouweland, Peter Borm, Guillermo Owen and Stef Tijs
Cost allocation and communication

470 Drs. J. Grazell en Drs. C.H. Veld
Motieven voor de uitgifte van converteerbare obligatieleningen en warrant-obligatieleningen: een agency-theoretische benadering

471 P.C. van Batenburg, J. Kriens, W.M. Lammerts van Bueren and R.H. Veenstra
Audit Assurance Model and Bayesian Discovery Sampling

472 Marcel Kerkhofs
Identification and Estimation of Household Production Models

473 Robert P. Gilles, Guillermo Owen, René van den Brink
Games with Permission Structures: The Conjunctive Approach

474 Jack P.C. Kleijnen
Sensitivity Analysis of Simulation Experiments: Tutorial on Regression Analysis and Statistical Design

475 C.P.M. van Hoesel
An $O(nlogn)$ algorithm for the two-machine flow shop problem with controllable machine speeds

476 Stephan G. Vanneste
A Markov Model for Opportunity Maintenance

477 F.A. van der Duyn Schouten, M.J.G. van Eijs, R.M.J. Heuts
Coordinated replenishment systems with discount opportunities

478 A. van den Nouweland, J. Potters, S. Tijs and J. Zarzuelo
Cores and related solution concepts for multi-choice games

479 Drs. C.H. Veld
Warrant pricing: a review of theoretical and empirical research

480 E. Nijssen
De Miles and Snow-typologie: Een exploratieve studie in de meubelbranche

481 Harry G. Barkema
Are managers indeed motivated by their bonuses?

482 Jacob C. Engwerda, André C.M. Ran, Arie L. Rijkeboer
Necessary and sufficient conditions for the existence of a positive definite solution of the matrix equation $X + A^T X^{-1} A = I$

483 Peter M. Kort
A dynamic model of the firm with uncertain earnings and adjustment costs

484 Raymond H.J.M. Gradus, Peter M. Kort
Optimal taxation on profit and pollution within a macroeconomic framework

485 René van den Brink, Robert P. Gilles
Axiomatizations of the Conjunctive Permission Value for Games with Permission Structures

486 A.E. Brouwer & W.H. Haemers
The Gewirtz graph - an exercise in the theory of graph spectra

487 Pim Adang, Bertrand Melenberg
Intratemporal uncertainty in the multi-good life cycle consumption model: motivation and application

488 J.H.J. Roemen
The long term elasticity of the milk supply with respect to the milk price in the Netherlands in the period 1969-1984

489 Herbert Hamers
The Shapley-Entrance Game

490 Rezaul Kabir and Theo Vermaelen
Insider trading restrictions and the stock market

491 Piet A. Verheyen
The economic explanation of the jump of the co-state variable

492 Drs. F.L.J.W. Manders en Dr. J.A.C. de Haan
De organisatorische aspecten bij systeemontwikkeling
een beschouwing op besturing en verandering

493 Paul C. van Batenburg and J. Kriens
Applications of statistical methods and techniques to auditing and accounting

494 Ruud T. Frambach
The diffusion of innovations: the influence of supply-side factors

495 J.H.J. Roemen
A decision rule for the (des)investments in the dairy cow stock

496 Hans Kremers and Dolf Talman
An SLSPP-algorithm to compute an equilibrium in an economy with linear production technologies

497 L.W.G. Strijbosch and R.M.J. Heuts
Investigating several alternatives for estimating the compound lead time demand in an (s,Q) inventory model

498 Bert Bettonvil and Jack P.C. Kleijnen
Identifying the important factors in simulation models with many factors

499 Drs. H.C.A. Roest, Drs. F.L. Tijssen
Beheersing van het kwaliteitsperceptieproces bij diensten door middel van keurmerken

500 B.B. van der Genugten
Density of the F-statistic in the linear model with arbitrarily normal distributed errors

501 Harry Barkema and Sytse Douma
The direction, mode and location of corporate expansions

502 Gert Nieuwenhuis
Bridging the gap between a stationary point process and its Palm distribution

503 Chris Veld
Motives for the use of equity-warrants by Dutch companies

504 Pieter K. Jagersma
Een etiologie van horizontale internationale ondernemingsexpansie

505 B. Kaper
On M-functions and their application to input-output models

506 A.B.T.M. van Schaik
Produktiviteit en Arbeidsparticipatie

507 Peter Borm, Anne van den Nouweland and Stef Tijs
Cooperation and communication restrictions: a survey

508 Willy Spanjers, Robert P. Gilles, Pieter H.M. Ruys
Hierarchical trade and downstream information

509 Martijn P. Tummers
The Effect of Systematic Misperception of Income on the Subjective Poverty Line

510 A.G. de Kok
Basics of Inventory Management: Part 1
Renewal theoretic background

511 J.P.C. Blanc, F.A. van der Duyn Schouten, B. Pourbabai
Optimizing flow rates in a queueing network with side constraints

512 R. Peeters
On Coloring j-Unit Sphere Graphs

513 Drs. J. Dagevos, Drs. L. Oerlemans, Dr. F. Boekema
Regional economic policy, economic technological innovation and networks

514 Erwin van der Krabben
Het functioneren van stedelijke onroerend-goed-markten in Nederland - een theoretisch kader

515 Drs. E. Schaling
European central bank independence and inflation persistence

516 Peter M. Kort
Optimal abatement policies within a stochastic dynamic model of the firm

517 Pim Adang
Expenditure versus consumption in the multi-good life cycle consumption model

518 Pim Adang
Large, infrequent consumption in the multi-good life cycle consumption model

519 Raymond Gradus, Sjak Smulders
Pollution and Endogenous Growth

520 Raymond Gradus en Hugo Keuzenkamp
Arbeidsongeschiktheid, subjectief ziektegevoel en collectief belang

521 A.G. de Kok
Basics of inventory management: Part 2
The (R,S)-model

522 A.G. de Kok
Basics of inventory management: Part 3
The (b,Q)-model

523 A.G. de Kok
Basics of inventory management: Part 4
The (s,S)-model

524 A.G. de Kok
Basics of inventory management: Part 5
The (R,b,Q)-model

525 A.G. de Kok
Basics of inventory management: Part 6
The (R,s,S)-model

526 Rob de Groof and Martin van Tuijl
Financial integration and fiscal policy in interdependent two-sector economies with real and nominal wage rigidity

527 A.G.M. van Eijs, M.J.G. van Eijs, R.M.J. Heuts
Gecoördineerde bestelsystemen
een management-georiënteerde benadering

528 M.J.G. van Eijs
Multi-item inventory systems with joint ordering and transportation decisions

529 Stephan G. Vanneste
Maintenance optimization of a production system with buffercapacity

530 Michel R.R. van Bremen, Jeroen C.G. Zijlstra
Het stochastische variantie optiewaarderingsmodel

531 Willy Spanjers
Arbitrage and Walrasian Equilibrium in Economies with Limited Information

IN 1992 REEDS VERSCHENEN

532 F.G. van den Heuvel en M.R.M. Turlings
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Refereed by Prof.Dr. H. Verbon

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Refereed by Prof.dr. J.M. Schumacher

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Refereed by Prof.dr. S.H. Tijs

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